

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (currently amended) A method for improving a thermal barrier coating comprising:

providing a substrate;

cryomilling MCrAlY without the inclusion of other metallic alloys to produce  
~~providing a bond coat composed substantially of nanocrystalline MCrAlY, where M is~~  
comprised of at least one of the group of Co, Ni and Fe;

thermally spraying the nanocrystalline MCrAlY ~~using a thermal spray process~~  
onto a metallic substrate; and

providing a ceramic top coat on the nanocrystalline bond coat.

2. – 10. (cancelled)

11. (currently amended) The method of claim 1 where cryomilling MCrAlY ~~providing~~  
~~the bond coat on the substrate comprises providing a nanocrystalline alumina coating~~  
~~by cryomilling an added alumina powder with the MCrAlY to achieve nanocrystalline~~  
grain sizes and disposing the cryomilled nanostructured alumina and MCrAlY composite  
coating on a bond coat on the substrate.

12. (original) The method of claim 11 where disposing the alumina powder on the bond coat comprises plasma spraying the nanocrystalline alumina powder onto the bond coat in the presence of oxygen.

13. (previously presented) A thermal barrier coating comprising:

a substrate;

a bond coat substantially composed of nanocrystalline MCrAlY without inclusion of other metallic alloys, where M is comprised of at least one of the group of Co, Ni and Fe, using a high velocity oxy fuel (HVOF) thermal spray process or low pressure plasma (LPPS) spray process onto the substrate; and

a ceramic top coat on the bond coat.

14. – 24. (cancelled)

25. (previously presented) A method for improving a MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

providing a MCrAlY bond coat on a substrate; and

providing a nanocrystalline nano-composite coating on the MCrAlY bond coat without inclusion of other metallic alloys where the nanostructured nano-composite coating is prepared by refining the microstructure of a MCrAlY powder used to make the nanostructure nano-composite coating to nanocrystalline grain size.

26. (cancelled)

27. (currently amended) The method of claim 25 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size comprises cryomilling the MCrAlY powder to nanocrystalline grain size through the in-situ formation of oxides, nitrides and/or oxynitrides.

28. (currently amended) The method of claim 25 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size comprises cryomilling the MCrAlY powder and refining the microstructure of the MCrAlY powder to nanocrystalline grain size during cryomilling through the introduction of  $\text{Al}_2\text{O}_3$  particles added during cryomilling.

29. (cancelled)

30. (previously presented) The method of claim 28 where refining the microstructure of the MCrAlY powder to nanocrystalline grain size achieved after cryomilling comprises introducing nano alumina whiskers during cryomilling.

31. (currently amended) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a first MCrAlY bond coat on a substrate; and

a second nanostructured nano-composite bond coat with nanocrystalline size MCrAlY grains without inclusion of other metallic alloys on the first MCrAlY bond coat on the substrate.

32. (cancelled)

33. (original) The thermal barrier coating of claim 31 where the nanocrystalline size MCrAlY grains are formed by cryomilling the MCrAlY powder during which the microstructure of the MCrAlY powder is refined to nanocrystalline grain size through the in-situ formation of oxides, nitrides and/or oxynitrides.

34. (currently amended) The thermal barrier coating of claim 31 where the nanocrystalline size MCrAlY grains are formed by cryomilling MCrAlY powder and refining the microstructure of the MCrAlY powder to nanocrystalline grain size after cryomilling through the introduction of  $\text{Al}_2\text{O}_3$  particles added during cryomilling.

35. (cancelled)

36. (previously presented) The thermal barrier coating of claim 34 where the nanocrystalline size MCrAlY grains formed achieved after cryomilling arise from nano alumina whiskers introduced during cryomilling.

37. (currently amended) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a substrate;

a nanocrystalline MCrAlY bond coat on the substrate without inclusion of other metallic alloys; and

a ceramic top coat on the fully-nanocrystalline bond coat.

38. (currently amended) The MCrAlY thermal barrier coating of claim 37 further comprising an  $\text{Al}_2\text{O}_3$  nanoparticle additive disposed throughout the fully-nanocrystalline MCrAlY bond coat which  $\text{Al}_2\text{O}_3$  nanoparticle additive was added during cryomilling of the MCrAlY powder.

39. (previously presented) The MCrAlY thermal barrier coating of claim 38 where the  $\text{Al}_2\text{O}_3$  nanoparticle additive was introduced as  $\text{Al}_2\text{O}_3$  powder added during cryomilling of the MCrAlY powder.

40. (previously presented) The MCrAlY thermal barrier coating of claim 38 where the  $\text{Al}_2\text{O}_3$  nanoparticle additive was introduced as  $\text{Al}_2\text{O}_3$  whiskers added during cryomilling of the MCrAlY powder.

41. - 42. (cancelled)

43. (previously presented) A MCrAlY thermal barrier coating made from MCrAlY powder, where M is a metal or metal alloy, comprising:

a substrate;

a nanocrystalline MCrAlY bond coat without inclusion of other metallic alloys on the substrate;

a ceramic top coat on the nanocrystalline bond coat; and

an Al<sub>2</sub>O<sub>3</sub> nanoparticle additive disposed throughout the nanocrystalline MCrAlY bond coat which Al<sub>2</sub>O<sub>3</sub> nanoparticle additive was added during cryomilling of a MCrAlY powder from which the nanocrystalline MCrAlY bond coat was formed.

44. (cancelled)

45. (previously presented) The method of claim 43 where the MCrAlY powder from which the nanocrystalline MCrAlY bond coat was formed was cryomilled with a model 1-S attritor or equivalent.